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Author(s): Tuulos, Tiina & Kauppinen, Tomi & Ivorra Penafort, L. R. & Riveros Ospina, D. I.

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## **Around the world in 36 hours - Understanding the dynamics of the global product design relay marathon**

**T. Tuulos**<sup>1</sup>

Project Manager  
Aalto Design Factory, Aalto University  
Espoo, Finland  
[tiina.tuulos@aalto.fi](mailto:tiina.tuulos@aalto.fi)

**T. Kauppinen**<sup>2</sup>

Project Manager, Docent  
Aalto Online Learning (AIOLE), Aalto University  
Espoo, Finland  
[tomi.kauppinen@aalto.fi](mailto:tomi.kauppinen@aalto.fi)

**L. R. Ivorra Peñafort**<sup>3</sup>

Staff, Professor  
Design Factory Javeriana Bogotá, Pontificia Universidad Javeriana  
Bogotá, Colombia  
[ivorral@javeriana.edu.co](mailto:ivorral@javeriana.edu.co)

**D. I. Riveros Ospina**<sup>4</sup>

Coordinator  
Design Factory Javeriana Cali, Pontificia Universidad Javeriana  
Cali, Colombia  
[dlriveros@javerianacali.edu.co](mailto:dlriveros@javerianacali.edu.co)

### **ABSTRACT**

In this system paper we will present a learning experiment - a unique three-day global product design relay marathon organized by the Design Factory Global Network (DFGN). The experiment called Rat Relay simulates a real-world situation in product development where very often a person or team is only working on a project for a limited time and not from beginning to end, individuals work in multidisciplinary and multicultural teams around complex problems, and everything is done with a fast pace. Rat Relay is a learning experiment developed by the Design Factory Global Network, a network of innovation hubs in universities and research organizations in five continents of the world aiming to contribute to transformation of learning and research through a passion-based culture of interdisciplinary collaboration and effective problem solving.

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<sup>1</sup> Corresponding Author  
T. Tuulos  
[tiina.tuulos@aalto.fi](mailto:tiina.tuulos@aalto.fi)

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## INTRODUCTION

In this paper we present the process and experiences gathered during the first official global product design relay marathon in the Design Factory Global Network, previously piloted in 2016 with four international hubs. The aim of this paper is to share learning outcomes and results of the exercise, and to further develop the approach for collaborative learning for the next round of Rat Relay.

## 1 THE SETTING

### 1.1 The concept of the experiment

The Rat Relay is focusing on finding novel ways to teaching product and service design in a global context and in distributed teams. The number of participating institutions is not limited or fixed. However, in this paper we will present how the experiment looked like with six participating institutions. The Rat Relay is an experiment about real-time global collaboration, and at the same time a local learning project where each institution offers for a local team a learning environment where the learning and working can take place. Further on, the institution representatives together with a company, start-up or NGO prepare a global, real-life challenge, and gather students to participate in teams of ca. five people, and invite teaching staff to act as coaches for the students.

This teaching and learning experiment is divided in six slots of six hours each, to complete a 36 hours' marathon in three days. Each slot represents a different phase of a design project. Each institution participating in the Rat Relay launches off their challenge during the first slot to their local team, which works on the given challenge for the first six hours. The challenge will then be passed on to a new country, just like runners pass on a baton in a relay, where a new interdisciplinary team works on the challenge in a next phase of the project for another six hours. In the end the challenges return back to the originating country for finalization of the outcomes. Table 1 presents (left table) an example of the schedule from Aalto Design Factory.

The six slots are distributed to three consecutive days, to morning and evening shifts by taking advantage of time zones to make a real-time relay between Europe and South America in this particular case. The distribution of the shifts in each location, according to the time zones, can be seen in Figure 1 (left table). Besides, in Figure 1 (right table) there is the distribution of the teams of the Rat Relay 2017 and the sequence of the projects going from one institution to another one; in the right table of the Figure 1, the meaning for the letters in the right- and leftmost columns are: "n" goes for "night", "m" goes for morning and "e" goes for evening. The far most left column represents European and right side South American time zones. The participating teams of 2017 are denoted as FIN (Finland), NED (Netherlands), POR (Portugal), SAN (Santiago, Chile), CAL (Cali, Colombia), BOG (Bogotá, Colombia).

GMT	Finland	Holland	Portugal	Santiago	Cali	Bogota										
	GMT +3	GMT +2	GMT +1	GMT -3	GMT -5	GMT -5										
00-01	02-03	01-02	00-01	20-21	18-19	18-19										
01-02	03-04	02-03	01-02	21-22	18-19	18-19										
02-03	04-05	03-04	02-03	22-23	20-21	20-21										
03-04	05-06	04-05	03-04	23-00	21-22	21-22										
04-05	06-07	05-06	04-05	00-01	22-23	22-23		FIN	NED	POR	SAN	CAL	BOG			
05-06	07-08	06-07	05-06	01-02	23-00	23-00	n	San						Cal	Bog	e
06-07	08-09	07-08	06-07	02-03	00-01	00-01	n									n
07-08	09-10	08-09	07-08	03-04	01-02	01-02	m	Fin	Ned	Por						n
08-09	10-11	09-10	08-09	04-05	02-03	02-03	e	Bog	Cal	San	Fin	Ned	Por	m		
09-10	11-12	10-11	09-10	05-06	03-04	03-04	n	Cal						Bog	San	e
10-11	12-13	11-12	10-11	06-07	04-05	04-05	n									n
11-12	13-14	12-13	11-12	07-08	05-06	05-06	m	Ned	Por	Fin						n
12-13	14-15	13-14	12-13	08-09	06-07	06-07	e	San	Bog	Cal	Ned	Por	Fin	m		
13-14	15-16	14-15	13-14	09-10	07-08	07-08	n	Bog						San	Cal	e
14-15	16-17	15-16	14-15	10-11	08-09	08-09	n									n
15-16	17-18	16-17	15-16	11-12	09-10	09-10	m	Por	Fin	Ned						n
16-17	18-19	17-18	16-17	12-13	10-11	10-11	e	Fin	Ned	Por	San	Cal	Bog	m		
17-18	19-20	18-19	17-18	13-14	11-12	11-12										e
18-19	20-21	19-20	18-19	14-15	12-13	12-13										
19-20	21-22	20-21	19-20	15-16	13-14	13-14										
20-21	22-23	21-22	20-21	16-17	14-15	14-15										
21-22	23-00	22-23	21-22	17-18	15-16	15-16										
22-23	00-01	23-00	22-23	18-19	16-17	16-17										
23-00	01-02	00-01	23-00	19-20	17-18	17-18										

Fig. 1. Working hours according to time zones and project sequence

Altogether this resulted into 216 hours (i.e. six locations times 36 hours) of project-based learning in globally distributed teams. The Rat Relay experiment took place in April 2017 in Design Factory learning platforms in six different universities: Aalto University in Finland (ADF), NHL University of Applied Sciences in Netherlands (FDF), Porto Polytechnic in Portugal (PDF), Duoc UC in Chile (DDF), and in Pontificia Universidad Javeriana in Colombia in two different cities Bogotá and Cali (DFJ).

Table 1. Rat Relay schedule example from Aalto Design Factory, Finland

	DAY 1 / Wed 26 April	DAY 2 / Thu 27 April	DAY 3 / Fri 28 April
Morning slot 8:00 - 14:00	<b>SLOT 1</b> - Project owner: ADF - Brief: International Trade Centre - Send to: DDF	<b>SLOT 3</b> - Project owner: FDF - Brief: Red Cross - Comes from: DFJ Cali - Send to: DDF	<b>SLOT 5</b> - Project owner: PDF - Brief: The city of Porto - Comes from: DFJ Cali - Send to: PDF
Evening slot 15:00 - 21:00	<b>SLOT 2</b> - Project owner: DFJ Bogota - Brief: Intellectus Centro de Memoria y Cognicion - Comes from: DFJ Bogota - Send to: DFJ Cali	<b>SLOT 4</b> - Project owner: DDF - Brief: Liberty Sequros - Comes from: DFJ Bogota - Send to: DFJ Cali	<b>SLOT 6</b> - Project owner: ADF - Brief: International Trade Centre - Comes from: FDF

## 1.2. Learning objectives

For students, the main learning outcome of the Rat Relay is to understand the necessity of work distribution in design or product development projects in a real global context. The idea is that only clear and constructive communication about the work done in one phase by one team will enable the best possible progress for the next teams in the relay. In addition, the students get to handle time pressure, improve and increase their argumentation skills for decisions they have made, and learn to document their projects via videos, illustrations, presentations, and photos. Learning outcomes also include process planning, product development skills, teamwork skills,

and application of design thinking process. The success of the exercise is assessed with the feedback that is gathered from the teams after each slot, and from the organization providing the challenge after the final results are presented to them.

In the same way, students are able to improve their conflict management skills when different situations take them out of their comfort zones. Students get to work with other students from different countries, disciplines, and languages, thus offering them an opportunity to gain practical information about different societies and communities. In this particular case, none of the participants was an English-speaking country. However, the official language of the Rat Relay was still English, which represented both a challenge and an opportunity for practicing and learning communication skills.

For faculty members or Design Factory representatives, in addition to the valuable experience of coaching the different phases of the project, there are many learning outcomes from the interactions between participating institutions. Essentially the rather short time window pushed participants and coaches to work in non-traditional ways finding ways to communicate ideas to next teams in the relay.

### **1.3. Six phases and slots**

The Rat Relay process was roughly built on six phases of product design, each one developed in a six-hours slot.

- 1st slot: understanding the brief, background research & identifying the user.
- 2nd slot: problem definition & benchmarking.
- 3rd slot: diverging & ideation.
- 4th slot: converging, concept definition & prototyping.
- 5th slot: refining the concept, iterating the prototype & testing with users.
- 6th slot: final prototyping & presentation.

However, following the Design Factory approach to product development, the design processes are not linear and the emphasis is made on the problem or need rather than on the process itself. In that sense, the Rat Relay teams were encouraged to jump across phases if the logic of the problem demanded it. This iteration is central in concept level development projects (Ulrich & Eppinger, 2016), in the Design Thinking approach (Brown, 2008) and in the TRIZ approach (Cavallucci, 2002).

### **1.4 Grand challenges to be solved**

All challenges in the Rat Relay had both a global aspect and a social benefit involved. The idea of the Triangle of Sustainability (Serageldin, 1995)—where all three aspects, economic, ecological and social need to be taken into account—was a key for both the organization of the Rat Relay and the development of the six different solutions to the challenges.

Firstly, the economic aspect was addressed by a symbolic fee for profit organizations participating from the Rat Relay and the fact that all the solutions needed to provide some level of market validation. Secondly, the ecological aspect was addressed in a way of work where the teams gained large global perspective to societal challenges and problems without the need to physical travel around the world thus reducing the carbon footprint related to transportation of the projects. Finally, the social aspect was addressed with the selection of the challenges, the alliance with organizations with a social conscience and the forming of diverse teams where every background and context was there to enrich the general capabilities of each local team.

In the Rat Relay experiment the six challenges were provided by the International Trade Centre based in Geneva, Liberty Seguros (insurance company in Chile), San Ignacio Hospital Memory and Cognition Center: Intellectus in Bogotá, Colombia, Social Foundation De Menos a Más for vulnerable population in Cali, Colombia, The International Red Cross in the Netherlands, and the City of Porto in Portugal.

The diversity of profiles and academic backgrounds of the participants makes this experiment particularly interesting. Due to the perceived nature of the product development marathon and the participating institutions, it could be more obvious to attract people from engineering, product design and business. However, the call for participants was open also for disciplines "at the border" such as arts, ethics or health sciences, and gathered also many of them to join. We argue that a global challenge will always need diverse points of view to be solved, thus calling for a collaborative environment beyond the boundaries of academic fields.

Table 2 depicts—as an example of the interdisciplinary nature of the Rat Relay—the background of the participants at the Aalto Design Factory in Finland. Of the 22 participants 18 were university students, one visiting scholar, one university faculty member and two junior high school students. The participants also represented 10 different schools and various disciplinary backgrounds. Similar interdisciplinary backgrounds were to be found also in other participating institutions. The majority of the participants in all six locations were BA and MA level students, but also many vocational students, industry professionals, university faculty, and even junior high school students participated the experience.

*Table 2. Backgrounds of the participants in Aalto Design Factory, Finland*

School	Number of Participants	Discipline
Aalto University of Arts, Design and Architecture	3	Industrial Design, Design, Collaborative and Industrial Design
Aalto University School of Science	2	Technical Physics, Computer Science
Aalto University School of Engineering	6	Production Engineering, Mechanical Engineering (3), Marine Technology, Product Development
Aalto University School of Business	3	International Design Business Management, Marketing, International Business
Aalto University School of Electrical Engineering	2	Microelectronics, Automation and Systems Technology
NHL University of Applied Sciences	1	Design
University of Helsinki	1	Finnish and Nordic History
Metropolia University of Applied Sciences	1	Digital Media
Arcada University of Applied Sciences	1	Media Management
Other	2	Junior High School

In the following sections, we will depict the Rat Relay as a unique learning method for global collaboration, present the data and experiences gathered in April 2017, analyse the process, and address future possibilities of research and next steps.

## 2. DATA GATHERING AND ANALYSIS

The data about the Rat Relay experiment was gathered through a survey taken by the participants after each time slot and through the reports of organizers in each Design Factory. The survey, which gathered 63 answers, looked into the diversity of the team, the previous design experience of the participants, the decisions made during the six hours' slot, interactions within teams, and the results of each round, accordingly. The intention was to support understanding the participant's attitudes and the dynamics within Rat Relay over the 36 hours' period. The analysis was done in a privacy-preserving and anonymous fashion. Table 3 presents the number of participants and coaches in each institution. The total number of participants in all six institutions was 166 with 30 coaches.

*Table 3. Number of participants and coaches in each institution*

Institution	DDF	ADF	FDF	DFJ Bogota	DFJ Cali	PDF
<b>Participants in total</b>	43	22	20	21	42	18
<b>Slot 1</b>	8	6	7	13	26	4
<b>Slot 2</b>	6	2	5	8	13	5
<b>Slot 3</b>	12	5	3	8	9	4
<b>Slot 4</b>	5	4	3	6	12	6
<b>Slot 5</b>	5	6	3	8	18	5
<b>Slot 6</b>	7	6	2	10	21	4
<b>Coaches</b>	8	5	3	3	7	4

### 2.1 Limitations and context

- The sign-up process was not restricted; everyone was able to sign up to the slot they wanted. This caused some unbalance to the teams.
- In some slots students participated only part of the time, however majority of the time the team participated for the whole six-hour slot. In Cali students worked also locally in parallel teams.
- The Rat Relay was a voluntary activity; students were not awarded ECTS credits.
- In Bogotá, the event took place at the Creative Room of the Ático Building, which was shared with other students who were working on their own activities, but were invited to participate mostly in the prototyping and validation slots.

### 2.2 Analysis of results

In order to support understanding of the Rat Relay experiment and its results we visualized the data gathered in the survey. In the survey our aim was to understand relevant aspects around these core questions; for example, Figure 2 depicts four core questions from the survey with answers in a five-point Likert scale, "1" being a strong disagreement and "5" meaning a strong agreement with the claim. Most participants (58%) found that their team's goals were clear and shared by all team members. Interestingly, more participants (46 % compared to 16%) tend to reflect more because of their designerly attitude. Slightly more (40% vs. 21%) of the participants found that design-based approach helps to improve efficiency. However, there was no clear difference between how participants see they attitude helps to use their imagination outside the working environment.

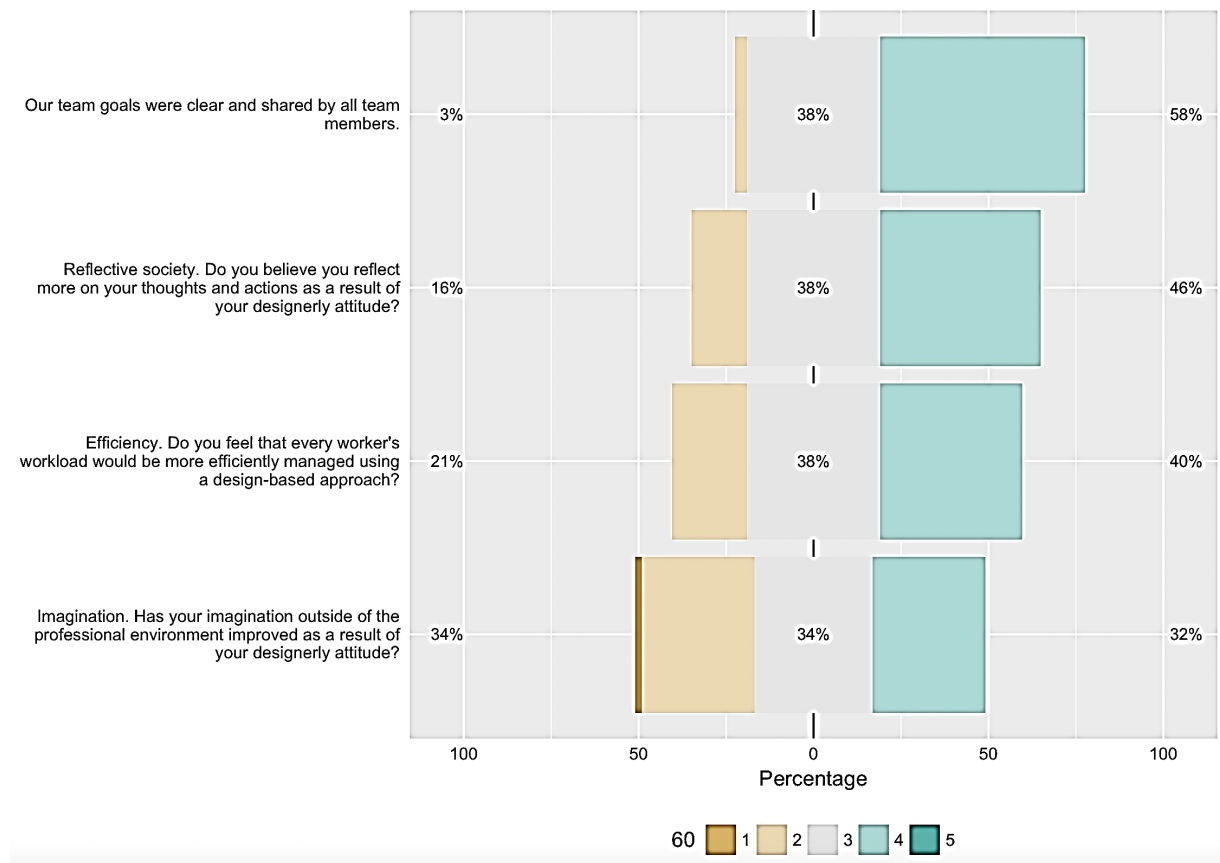


Fig. 2. Answers to four core questions of the survey visualized.

### 3. LEARNING OUTCOMES & DISCUSSION

The Rat Relay marathon was organized for the first time with students and real company partners in April 26th to 28th 2017. The feedback gathered from the participants, company partners, and organizing institutions was crucial in analysing the success of the learning experiment and the next steps.

#### 3.1 Student experience

The students reported that they especially enjoyed the intensive nature of the relay marathon to work against the clock and with real time with other Design Factories. They appreciated both the diversity of the teams, and the challenges. The participating students liked the unique approach to work only on a certain part of a project, and thus expected to build on others' ideas, and to send over their progress to the next team in an understandable and compact way. They felt that the communication between the different slots, without any face-to-face communication in between, was the biggest challenge but also the biggest learning experience.

Communication was perceived as one of the big challenges since English language was the main language of the Rat Relay amongst non-native English speakers. To convey ideas and thoughts better, students used drawings, visualizations, pictures, acting, body language, and even music and movie references to enable assertive communication between the slots.



### 3.2 Sponsor experience

Although the Rat Relay experiment was only a 36 hours' project, all the sponsors received a proper design solution for their challenges, making the six slots division a powerful methodology tool. The phases assigned to each slot were not fixed but worked perfectly as a guide to understand and achieve deliverables for each phase. The NGOs and industry partners providing the real-life challenges were all surprised of the amount of ideas and content students were able to produce in just three days.

Several partners reported afterwards how the Rat Relay was also a great learning experience for them to design and frame their challenges in a better way for student projects. Within the Rat Relay they were able to test an idea and a challenge very quickly and see the end results directly after 36 hours.

### 4. SUMMARY

In this paper we reported about the Rat Relay experiment, a 36 hours' marathon to provide design-based solutions to a variety of challenges provided by companies, universities and NGOs. We presented the setting, including the idea to have several locations around the world, and how draft designs were passed to following teams in other locations, thus creating a relay effect.

We provided the first analysis and visualization of results of the survey to support understanding the experiment, and also to see how participants think their designerly attitude can help in societal questions. We also presented and discussed the learning outcomes for students. As we evidenced, students found the creative communication between slots without any face-to-face communication to be both most challenging and most supportive for their learning. Organizations that provided the challenge-based tasks for the Rat Relay were both surprised and satisfied about the results.

As a part of the future work we plan to analyse and visualize all the data collected from the survey from this first official Rat Relay experiment. For instance, it will be interesting to look more closely into what influenced students' decisions and whether previous design experience of participants plays a role in the decision-making and final outcomes. The next round of the Rat Relay will take place in the first part of 2018, and we are looking to have more participating institutions, more students, and more coaches, and to use the experiences and results presented in this paper to create an even more engaging setting.

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